In The Claims

The originally presented claims of record are as follows:

1. (original): A process for determining the moisture content of a material comprising:

producing a primary microwave signal with a varying frequency, said signal being a continuously varying signal or a discrete time varying signal,

splitting said primary signal to provide first and second microwave signals, said first signal to be transmitted through said material and said second signal comprising an internal reference signal,

transmitting said first signal through at least a portion of said material,

receiving at a receiver a third signal which comprises potential multi-path interference signals and said first signal which has passed through said material,

mixing said third signal together with said second signal, generating a mixed signal,

filtering said mixed signal to remove substantially all of said multi-path interference signals, generating a filtered-mixed signal

measuring the frequency of said filtered-mixed signal to determine the propagation delay of said first signal after it has passed through said material, and

calculating the moisture content of said material from said propagation delay of said first signal after it has passed through said material,

wherein the frequency of said primary signal varies sufficiently rapidly that the frequency of said third signal and said second signal will be different when they are received at said receiver.

2. (original): The process of Claim 1 wherein said material is selected from the group consisting cotton, hay, grain, tobacco, timber, lumber, and pulp.

3. (original): The process of Claim 1 wherein said material comprises a cotton bale.

4. (original): The process of Claim 1 further comprising determining the density of said material, and wherein said moisture content is calculated from a calibration equation which utilizes said propagation delay and said density.

5. (original): The process of Claim 4 further comprising determining the transmission path-length of said first signal through said material, and wherein said moisture content is calculated from a calibration equation which utilizes said transmission path-length, said propagation delay, and said density.

6. (original): The process of Claim 1 wherein said primary microwave signal comprises a discrete time varying signal.

7. (original): The process of Claim 1 wherein said primary microwave signal comprises a continuously varying signal.

8. (original): The process of Claim 7 wherein said primary microwave signal whose frequency is continuously varying is produced by a microwave voltage controlled oscillator with a continuously varying voltage source.

9. (original): The process of Claim 8 wherein the frequency of said primary microwave signal produced by said voltage controlled oscillator varies over a range of less than about 250 MHZ.

10. (original): The process of Claim 9 wherein the frequency of said primary microwave signal produced by said voltage controlled oscillator varies over a range of less than or equal to about 100 MHZ.

11. (original): The process of Claim 9 wherein the frequency of said primary microwave signal produced by said voltage controlled oscillator varies over a range of less than or equal to about 50 MHZ.

12. (original): The process of Claim 1 wherein said filtering of said mixed signal to remove substantially all of said multi-path interference signals comprises:

sampling said mixed signal with an analog to digital converter to form a discrete sampled mixed signal

filtering said discrete sampled mixed signal with a digital filter to remove substantially all of said multi-path interference signals, thereby generating said filtered-mixed signal.

13. (original): The process of Claim 1 wherein the determination of said propagation delay comprises determining the phase-constant or phase velocity of said material.

14. (original): The process of Claim 1 further comprising determining the propagation delay in the absence of said material comprising:

transmitting said first signal through air in the absence of said material,

receiving a third calibration signal which comprises said first signal which has passed through said air and potential multi-path interference signals,

mixing said third calibration signal together with said second signal, generating a mixed calibration signal,

filtering said mixed calibration signal to remove substantially all of said multi-path interference signals, generating a filtered-mixed calibration signal

measuring the frequency of said filtered-mixed calibration signal to determine the propagation delay of said first signal after it has passed through said air, and

calculating the moisture content of said material from said propagation delay of said first signal after it has passed

through said material and said propagation delay of said first signal after it has passed through said air.

15. (original): The process of Claim 1 wherein said frequency of said first signal varies at a first controlled repetition rate.

16. (original): The process of Claim 15 wherein said first controlled repetition rate is greater than or equal to about 1 KHz.

17. (original): The process of Claim 15 further comprising repeating all of said producing, splitting, transmitting, receiving, mixing, filtering, measuring, and calculating steps wherein said frequency of said first signal varies at a second controlled repetition rate which is different from said first controlled repetition rate, and determining a mean moisture content from the moisture content calculated at each of said first and second controlled repetition rates.

18. (original): The process of Claim 17 further comprising repeating all of said producing, splitting, transmitting,

receiving, mixing, filtering, measuring, and calculating steps wherein said frequency of said first signal varies at numerous controlled repetition rates which are different from said first controlled repetition rate, and determining a mean moisture content from the moisture content calculated at each of said first and other controlled repetition rates.

19. (original): The process of Claim 1 wherein the frequency of said primary microwave signal varies over a range of less than about 250 MHZ.

20. (original): The process of Claim 19 wherein the frequency of said primary microwave signal varies over a range of less than or equal to about 100 MHZ.

21. (original): The process of Claim 20 wherein said material comprises a cotton bale.

22. (original): The process of Claim 19 wherein the frequency of said
primary microwave signal varies over a range of less than or equal to about 50 MHZ.

23. (original): The process of Claim 22 wherein said material comprises a cotton bale.

24. (original): An apparatus for automatically determining the moisture content of a material comprising:

a microwave signal generator effective for producing a microwave signal with either a continuously varying frequency or a discrete time varying frequency,

a microwave signal transmitter effective to transmit said microwave signal through the material,

a microwave signal receiver effective to receive said microwave signal after it has passed through said material,

a microwave signal mixer effective for mixing said microwave signal received by said receiver and a reference signal to generate a mixed signal,

a microwave signal filter effective to remove substantially all multipath interference signals to generate a filtered-mixed signal, and

a frequency detector effective to determine the frequency of said filtered-mixed signal,

wherein the frequency of said primary signal varies sufficiently rapidly that the frequency of said third signal and said second signal will be different when they are received at said receiver.

25. (original): The apparatus of Claim 24 further comprising a microprocessor coupled to said frequency detector and effective for calculating the moisture content from the frequency of said filtered-mixed signal.